

Queens University, Belfast. Northern Ireland. UK. Research and Scholarship

1. Tissue Regeneration

Collaboration Direction: U Mass Lowell to Queens Univ.

Queens Contact: Dr. Glenn Dickson, *Head of Tissue Engineering*

UMass, Lowell Contact: Dr. Susan Braunhut, *Biology & Nanomanufacturing Center*
Dr. Daniel Schmidt, *Plastics Eng. & Nanomanufacturing Center*

Dr. Glenn Dickson is an anatomist and senior lecturer at QUB who is re-tooling to perform regenerative medicine. He is working with investigators in the engineering school to examine the use of ceramic polymeric scaffolds to seed with cells and growth factors for use as hip and joint replacements. He is seeding ceramic polymers with chondrocytes and FGF in an attempt to recruit mesenchymal stem cells from bone marrow into the bio-scaffolds and stimulate bone reconstruction and vascularization of prosthetics for joint replacement. He has recently visited Univ. Pittsburgh McGowan Institute where Dr. Braunhut has collaborators to analyze his ceramic polymeric support systems.

Dr. Susan Braunhut is the only investigator doing regenerative medicine. Dr. Dickson would also be able to collaborate with some of the polymer scientists on his bio-scaffold materials. His approach is dated and he could benefit from some of the newer approaches to regenerative medicine and biocompatible polymers. Approaches to actively recruit stem cells to the prosthetic and the new stem cell bank at U Mass Worcester would be provided if he had a collaborator at U Mass Lowell as well as new advanced materials for prosthetics and biologics that could be added to scaffolds and direct migration, proliferation and finally differentiation of cells in regenerative remodeling.

Dr. Schmidt's scholarly interests include the production of polymer hybrids, including low and high inorganic content nanocomposites and pre-ceramic systems, and porous materials, including tissue engineering scaffolds, polymer-derived catalyst supports and shape memory foams.

2. Radiotherapy

Collaboration Direction: Reciprocal

Queens Contact: Dr. Dennis McCance, *Director of Cancer Institute*

UMass, Lowell Contact: Dr. Susan Braunhut, *Biology & Nanomanufacturing Center*, Dr. David Wegman and Dr. Partha Chowdhury.

Dr. Dennis McCance is the Director of the new Cancer Institute, Human Tissue Bank Registry, a state of the art facility in cancer biology and translational research including non-Small cell lung Carcinoma treatment and diagnosis, cystic fibrosis epidemiology and treatment. Dr. McCance specializes in microbeam x-ray, tissue databases, translational research, CF and NSCLCa.

Radiotherapy: We have considerable expertise in radiation research including: gamma, neutron, x-ray, alternating magnetic field and thermal. QUB has a microbeam x-ray machine for

subcellular organelle radiation studies of interest to *investigators in the Physics* department and *Dr. Brauhn*.

Tissue Bank Registry data mining: *Dr. Georges Grinstein* might want access to the human cancer tissue database they have accumulated and might be able to provide unique visualization of the data sets and bioinformatic data mining to reveal unappreciated patterns of treatment response and diagnosis.

Small cell lung Carcinoma treatment and diagnosis - *Dr. Grinstein* again for the above reasons.

Cystic fibrosis epidemiology and treatment- *Dr. Grinstein* for the above reasons. *Dr. Don Milton or Dr. David Wegman and Dr. Ken Geiser* might be interested in the environmental effects leading to the high incidence of CF in Ireland.

Medical Imaging: QUB has a large effort in medical imaging and they might be of interest to *Dr. Bill Goodhue* and might have interest in our sub-millimeter-Wave Photonics facility.

3. Nanoparticle/Drug Delivery

Collaboration Direction: Reciprocal

Queens Contact: **Professor Chris Shaw**, *School of Pharmacy*.
 Karl Butterworth, *School of Pharmacy*.

UMass, Lowell Contact: **Dr. Bridgette Budhlall**, *Plastics Eng. & Nanomanufacturing Center*
 Dr Stephen McCarthy, *M2D2*, and **Dr. Arthur Watterson**, *Chemistry*

The McClay Research Centre provides research laboratories for the School's programs in Drug Delivery, Medical Devices, Pharmaceutical Materials Science and Biomolecular Science utilizing colloidal gold nanoparticles for cancer tumor ablation. The Centre also houses specialized areas that include suites for advanced microscopy, pharmaceutical thermal analysis and tissue culture.

Dr. Budhlall is the only investigator at UMass synthesizing and characterizing functional nanobiocolloids:- vesicles, colloidosomes, polymersomes and polymer hydrogel/nanoparticles nanocapsules that incorporate colloidal gold nanoparticles that comprise stimuli-responsive responsive polymer microcapsules with a polymer shell and liquid-core for drug delivery applications.

4. Plastic and Polymers Research Centre

Collaboration Direction: Reciprocal

Queens Contact: **Professor Peter Hornsby**, *Chair of Polymer Engineering*
 Dr. Tony McNally, *Polymer Engineering*

UMass, Lowell Contact: **Drs. Steve McCarthy, Robert Malloy and Nick Schott**, *Plastics Eng.*

Dr. Steve McCarthy met with Professor Peter Hornsby, Chair of Polymer Engineering and Dr. Tony McNally, faculty member. Polymer Engineering is part of the School of Mechanical and Aerospace Engineering. The expertise at Queens is in Extrusion Processing, Rotational Molding,

and Thermoforming. There is extensive polymer processing equipment and instrumentation in these areas as well as Analytical Expertise. Queens has greater capability and expertise in Rotational Molding and Thermoforming than UMass Lowell. UMass Lowell has greater expertise in Injection Molding and Blow Molding.

Dr. Nick Schott has more than 40 years experience in Rotational Molding, Thermoforming, Blow Molding, Injection Molding, and Plastics Extrusion. Extrusion is well developed in both schools. There was considerable interest in collaborations between the two programs. The collaboration could include all members of the Plastic and Polymers Research Centre at Queens and the Department of Plastics Engineering at UMass Lowell. Faculty members from Queens Univ. are planning a trip to Lowell in early 2009 to pursue this collaboration.

5. Super Hydrophobic Coatings

Collaboration Direction: Reciprocal

Queens Contact: **Dr. Steven Bell**, *Director of Research, Innovative Molecular Materials (IMM) Group. School of Chemistry and Chemical Engineering.*

UMass, Lowell Contact: **Dr. Bridgette Budhlall**, *Plastics Eng. & Nanomanufacturing Center*

Research in the IMM group is centered on understanding, characterizing and controlling the properties of molecular materials, many of which have mesoscale (nm-mm) structure.

Dr. Budhlall has broad expertise in Nanostructured Polymer Coatings Science & Technology and has more than eight (8) years working in industry on architectural emulsion polymer coatings and is currently conducting research on water-borne hybrid nanoparticle/polymers for automotive coatings with improved barrier properties including superhydrophobicity. Dr. Budhlall also currently teaches two (2) graduate level courses in coatings: **26.533 – Coatings Science and Technology I and II** that review the principles of design and formulation of waterborne, high-solids, and powder resins used for the development of solvent-less green coatings and the use of bio-derived resins, including soybean oil and other renewable raw materials. The mechanisms and methods of curing and of polymerization for polymers used as coatings are also covered.

6. Bioplastics

Collaboration Direction: Reciprocal

Queens Contact: **Dr. Tony McNally**, *Polymers Research Center*
Dr. Glenn Dickson, *Head of Tissue Engineering Research Team. School of Medicine.*

UMass, Lowell Contact: **Drs. Steve McCarthy, Ram Nagarajan, and Sanjeev Manohar.**

The area of Bioplastics is an emerging field which requires development of novel designs, blends, and processing techniques. These polymers include poly lactic acid, poly hydroxalkanoates as well as polysaccharides. Tony McNally of the Plastic and Polymers Research Center and Glenn Dickson are interested in collaborations from Queens.

7. Green Chemistry

Collaboration Direction: Reciprocal

Queens Contact: Prof. Jim Swindall, Prof. Ken Seddon, and Prof. Robin Rogers,
Co-Directors, Queens University Ionic Liquids Laboratory, QUILL

UMass, Lowell Contact: Drs. Ram Nagarajan, Jayant Kumar and Sanjeev Manohar and
Toxic Use Reduction Institute (TURI)

Queens University has considerable expertise in Ionic Liquids through the QUILL, Queens University Ionic Liquids Laboratory. This collaboration currently includes the University of Alabama. QUILL currently has 14 industrial members. UMass Lowell collaborators would include the faculty in Green Chemistry and the Toxics Use Reduction Institute.

8. Plastics Industrial Seminars

Collaboration Direction: Reciprocal

Queens Contact: Prof. Peter Hornsby, *Chair of Polymer Engineering*

UMass, Lowell Contact: Prof. Robert Malloy, *Chair of Plastics Engineering*

Prof. Peter Hornsby, Chair of Polymer Engineering at Queens, was previously the Executive Director of the Wolfson Centre for Materials Processing at Brunel University, during which time he was involved in the partnership with the Plastics Industrial Seminars with UMass Lowell. Prof. Hornsby expressed interest in collaboration between Queens and UMass Lowell in Plastics Industrial Seminars. This collaboration would exchange faculty between the schools to present the Seminars during which time the faculty would interact with members of the host school. The travel expenses would be covered by the Industrial participants. Participants from Queens would include members of the Plastic and Polymers Research Centre and participants from UMass Lowell would include the faculty of the Department of Plastics Engineering.

9. Knowledge Transfer

Collaboration Direction: Reciprocal

Queens Contact: Mr. John Thompson, *Director of the Knowledge Exploitation Unit*

UMass, Lowell Contact: Dr. Steve McCarthy, *Plastics Engineering & M2D2*
Dr. George Kachen, *CVIP*

The Knowledge Exploitation Unit of Queens identifies intellectual property with commercial potential and exploits the IP through spin-out activity, licensing, and contract research. Mr. John Thompson, director of the Knowledge Exploitation Unit, met with Steve McCarthy. Mr. Thompson has been extremely successful in establishing spin-out companies based on Queens Intellectual Property. Mr. Thompson was extremely interested in the M2D2 model of helping companies which have developed their own IP. Mr. Thompson will visit UMass Lowell in 2009 to discuss future collaboration. Potential includes Queens helping UMass Lowell in Spin-out development and UMass Lowell helping Queens with incubator/accelerator activities similar to M2D2.

10. Music and Sonic Arts

Collaboration Direction: Reciprocal

Queens Contact: **Dr. Sile O'Modhrain**, *Sonic Arts*

Prof. Michael Alcorn, *Head of School of Music and Sonic Arts*

UMass, Lowell Contact: **Prof. Alex Case**, *Sound Recording Technology*

The Music Programs of Queens University Belfast (QUB) and University of Massachusetts Lowell have much in common in that they are traditional music programs that have grown to add strong music technology disciplines within. QUB's School of Music and Sonic Arts offers two undergrad degrees: a Bachelor of Music and a Bachelor of Science in Music Technology. UMass Lowell's School of Music offers a single Bachelor of Music degree. The music technology areas in which each university has invested most, however, are in fact complementary, not redundant.

QUB, under the direction of electronic music composer, **Michael Alcorn**, has created an electronic arts program called the Sonic Arts Research Centre (SARC), founded in 2001. SARC is a creative laboratory where research focuses on the creation of new forms of musical instruments and on composition of electro-acoustic art. Their key facility is very unique performance space in which the listeners are surrounded by 40 individual, uniquely addressable loudspeakers – around, above and below. As demonstrated to the delegation by Dr. Sile O'Modhrain, the audience sits on an acoustically transparent grid, suspended in the center of a three story space. The unoccupied bottom floor has a ring of loudspeakers. The fly space well above the audience has a ring of loudspeakers. And the seating plane itself has two rings of loudspeakers. The result is a phenomenally flexible and enveloping electro-acoustic canvas for composition unequalled at our institution.

While QUB focuses on sound immersive compositions and alternative controllers for music performance, they have relatively little in the form of more traditional multi-track music production tools. This is exactly where the Sound Recording Technology (SRT) Program at UMass Lowell shines. We have state of the art curriculum, research and facilities in the more common mode of loudspeaker presentation of sound art: stereo and surround contemporary recorded music. Our multi-track recording studios and critical listening classroom have enabled us to be a world leader in the study and creation of sound recordings.

Prof. Case is aware from advising students that many SRT undergraduate and graduate students have a strong interest in sound synthesis and composition. Our two popular courses in this field and more modest electro-acoustic spaces can not possibly offer the same depth of experience as SARC – a natural point for collaboration. Meantime, SARC has invested comparatively little in multi-track production technologies and their students and faculty are hungry for more – leading to a symmetric need for collaboration.

On the face of it, it would appear there is plenty of opportunity for collaboration in research, and exchange of faculty and students. I must note, however, that SRT does possess faculty with strong credentials in electronic music composition (n.b. **Dr. William Moylan** and **Dr. John Shirley**). Moreover, SRT students are high quality musicians, many with a strong passion for and appropriate aptitude to delve into this adjacent field. We lack only the deep investment in facilities needed to empower very high quality work in this domain, here on our campus.

In the meantime, our SRT faculty and facilities are already taxed near their reasonable limits. With only three fulltime SRT faculty serving the curricular needs of both undergraduate and graduate SRT students, exchange of faculty would materially impact our ability to serve our existing program. Our recording studios are near full utilization; students regularly work in our studios overnight, ending sessions at sunrise having worked all night (this is the norm, not the exception). It is not clear that there is room for any additional faculty and/or students from SARC, for classwork or recording sessions.

In the end, the complementary capabilities of SARC and SRT, while exciting, may do more to flag additional forms of scholarship and additional curriculum that would be a good fit if housed entirely within UMass Lowell. Literal collaboration risks diluting our current strong offerings.

The delegation from UMass Lowell to QUB included non-music faculty. One 'north campus' faculty member noted that most SARC graduate students have science undergraduate backgrounds. Computer Science, Electrical Engineering, and Digital Signal Processing fit naturally with music technology. UMass Lowell SRT currently offers a minor in SRT to Computer Science and Electrical Engineering undergrads. This is an underutilized but exciting option. Our undergraduate programs are so (admirably) demanding that few students actually have the flexibility in electives to make the SRT minor work. Our relatively new Master of Music in Sound Recording Technology Program requires an undergraduate music degree and effectively rules out those possessing only a science undergraduate degree. SRT has always been oriented toward the aesthetic application of technology, and has been very successful with music at its foundation. If SARC is a model suggesting additions and/or variations to our program, the science orientation should likely be toward the existing, very strong science programs already at UMass Lowell first, with potential collaboration at SARC a second choice. The science/music integration, if viewed as a positive by our institution, is rich with local opportunity.

In curriculum, research, faculty and facilities, QUB SARC flags popular and exciting opportunities that are a great strategic fit with UMass Lowell SRT. However, the strategic fit does not easily translate into actual international collaboration without some tailoring of resources. In fact, these opportunities can be better realized through better alignment of UMass Lowell's existing areas of music and technology leadership. Through collaboration between programs of UMass Lowell's south and north campuses, SRT can become an even stronger, more active engine for the creative economy.

11. Irish Studies

Collaboration Direction: Queens Univ. to UMass, Lowell

Queens Contact: **Prof. Richard English**, *Head of Irish Studies at Queens*
Contact TBD, *St. Mary's College, West Belfast*

UMass, Lowell Contact: **Dr. Melissa Pennell**, *Chair, English Department*
Drs. Todd Avery and Jeannie Judge, *English*

Queens has an established Irish Studies program that could provide a source for Faculty collaboration with U Mass Lowell. In addition, members of the staff at St. Mary's, a QUB affiliated college in Belfast has a tradition of more community based Irish Studies and may provide contrasting approaches to Irish Studies at U Mass Lowell.

12. Internship Opportunities in Various Disciplines

Collaboration Direction: Reciprocal

Queens Contact: **Prof. Gerry MacCormac**, *Pro-Vice Chancellor, Queens University*

UMass, Lowell Contact: **Internship Office, Dr. Frank Talty**, *Washington Center liaison*
and Dr. David Eberiel, *Biology*

Irish students interested in internships in Washington, DC or elsewhere might avail themselves of opportunities currently available to U Mass Lowell students. UML students may engage in internships in Ireland, perhaps in the summer.

13. Clean Technology

Collaboration Direction: Reciprocal

Queens Contact: **Queens University Environmental Science and Technology Research Centre (QUESTOR)**

UMass, Lowell Contact: **Environmental Sciences (Civil Engineering), TURI, Green Chemistry, and Renewable Energy faculty.**

QUESTOR, the Queens University Environmental Science and Technology Research Centre, is a NSF IUCRC Center established in 1989 for environmental science and technology. Currently the focus is on water, soil and air remediation technologies, as well as waste management and recycling, pollution prevention, and renewable energy. There are currently 20 Industrial members as well as 5 academic partners, including Stevens. QUESTOR is seeking additional academic partners. Potential UMass Lowell participants include Environmental Sciences (Civil Engineering), TURI, Green Chemistry, and Renewable Energy faculty.

14. Peace and Reconciliation

Collaboration Direction: Queens Univ. to UMass, Lowell

Queens Contact: **Mairtin O'Miller, *Publisher Irish Echo Newspaper***

UMass, Lowell Contact: **Dr. Frank Talty, *Political Science***

Members of the Belfast Community, introduced by Mairtin Miller, publisher of the Irish Echo Newspaper, provide a possible source of scholars for the Greeley Peace Fellowship at U Mass Lowell. Experience with the Irish Peace process would be an appropriate source for research and education in peace studies.

15. Facilities Management / Food/ Athletics / Revenue Development

Collaboration Direction: Queens Univ. to UMass, Lowell

Queens Contact: **Prof. Gerry MacCormac, Pro-Vice Chancellor, Queens University**

UMass, Lowell Contact: **Dr. Joanne Yastremski, Louise Griffin and other appropriate UML Staff and Health School**

Queens recently undertook a wholesale restructuring of its food and athletic services in order to achieve higher quality and lower costs, in fact profits, from its food service contractors and its athletic facilities. Administrative strategies learned at Queens may be of value to U Mass Lowell going forward.

Dublin City University (DCU), Dublin. Republic of Ireland. Research and Scholarship:

1. Biosensors and Biomimetics

Collaboration Direction: Reciprocal

DCU Contact: National Center for Sensor Research (NCSR) and CLARITY

UMass, Lowell Contact: Dr. Susan Braunhut, Nanomanufacturing Center Sensor Group

A large group of scientists have been recruited to occupy a new building with utilize state of the art facilities and will build a series of biosensors for point of care and home devices to detect early signs of human and animal disease (veterinary). Diagnosis and self management of health with remote sending of data to a health care management center are envisioned. They have programs in microfluidics, and surface science bioassays such as fluorescent antibody based biochips for applications in human cardiology (cardiovascular disease risk), ovarian and cervical cancer, respiratory health (cystic fibrosis early detection), hematology (specialty myeloma) and blood coagulation and bovine mastitis. They are developing air sampling devices, wearable biosensors, and work environment detectors for air quality. They have a robotic fish to inspect public waterways and reservoirs. Main investigators are **Drs. Diamond, O’Kennedy, Lau, Williams, Kenny, MacCraith, Killard and Forster.**

CLARITY is a research centre that focuses on the intersection between two important research areas-Adaptive Sensing and Information Discovery-to develop innovative new technologies of critical importance to Ireland's future industry base and contribute to improving the quality of life of people in areas such as personal health, digital media and management of our environment. The overarching theme of CLARITY's research program -bringing information to life- refers to the harvesting and harnessing of large volumes of sensed information, from both the physical world in which we live, and the digital world of modern communications & computing. The technology developed by CLARITY will help to empower the citizen by taming the information overload problem currently facing individuals, helping to ensure that everyone has access to the right information at the right time. CLARITY represents a large-scale academic-industry collaboration, accommodating more than 100 full-time researchers in partnership with more than 10 industrial partners, including major multinationals and emerging Irish companies. CLARITY will provide Irish researchers and industry with a unique opportunity to create and commercialize strategic intellectual property, producing viable solutions that can be rapidly exploited. This will lead to significant and sustainable, high-value job creation opportunities in areas of high socio-economic impact to Ireland.

At U Mass Lowell we have a very large Sensor group interested in many of the same approaches to counterterrorism detection systems that could be modified for some of the above peace time applications in biomedicine, bioremediation, and work environment monitoring. Our investigators include: **Kurup, Pradeep; McDonald, Melisenda; Wang, Xingwei ; Faust, Rudolf; Manohar, Sanjeev ; Braunhut, Susan; Barry, Carol; Kumar, Jayant; Therrien, Joel ; Kim, Byungki ; Shen, Mengyan ; Marx, Kenneth; Sun, Hongwei; Sandman, Daniel.**

2. Nanoencapsulation

Collaboration Direction: Reciprocal

DCU Contact: Prof. Ian Marison, *Head of School of Biotechnology*

UMass, Lowell Contact: Dr. Bridgette Budhlall, *Plastics Eng. & Nanomanufacturing Center*

Dr. Marison's nanoencapsulation research focuses on new drug discovery using cationic peptides for a wide range of applications including food technology (emulsifying agents), encapsulation, insecticides, flocculents in water treatment, antimicrobial peptides, larvicidal activity (Anopheles). The School of Biotechnology is a strategic unit in the Faculty of Science and Health at Dublin City University. Located in a state of the art building which incorporates both teaching and research facilities together with a pilot plant, the School is unique in having Process Engineers, Biochemists, Microbiologists, Geneticists and a Pharmacologist within a single departmental unit, thus encouraging inter-disciplinary approaches to teaching and research. The School is an active centre of basic and applied research. Members of staff have collaborative links with national and international research laboratories and researchers in the school also work in close collaboration with centers of excellence based at DCU, in particular the National Institute for Cellular Biotechnology (NICB) and the NCSR.

Dr. Budhlall is the only investigator at UMass synthesizing and characterizing functional nanobiocolloids:- vesicles, colloidosomes, polymersomes and polymer hydrogel/nanoparticles nanocapsules that incorporate colloidal gold nanoparticles that comprise stimuli-responsive responsive polymer microcapsules with a polymer shell and liquid-core for drug delivery applications.

3. Bioprocessing

Collaboration Direction: Reciprocal

DCU Contact: Prof. Ian Marison, *Head of School of Biotechnology*

UMass, Lowell Contact: Dr. Carl Lawton, *Dept. Chemical Engineering. Biomufacturing*

Dr. Marison's Bioprocess monitoring/ control research combines calorimetry, spectroscopy (FTIR, fluorescence etc.), dielectrics etc for use in bioprocess optimization, product quality, standardization (regulatory aspects), increased productivity, high cell density culture applications.

Dr. Lawton's scholarly interest includes the development of advanced materials with unique electronic, optical, structural, or interfacial properties; development of efficient manufacturing processes for the biotechnology industry.

4. Molecular Spectroscopy & Photochemistry

Collaboration Direction: Reciprocal

DCU Contact: Dr. Tia Keyes, *National Centre for Sensor Research (NCSR)*

UMass, Lowell Contact: Dr. Jayant Kumar, *Adv. Mat. Center & Physics*
Dr. William Goodhue, *UML Photonics Center & Physics*

The research program at NCSR includes both fundamental and applied projects, ranging from basic studies of molecular interactions to prototype development for industrial partners. NCSR is focused on developing future sensing technologies for economic and societal benefit for application in personal health monitoring and diagnostics, environmental monitoring, (bio) process optimization and nano/bio-medicine. NCSR has prioritized research in the areas of:

1. Fundamental Materials Science: Nano-Micro-Bio Materials Convergence
2. Environment (Monitoring) Technologies
3. Nanomedicine

Dr. Kumar's expertise is in the areas of Optical and electronic properties of materials, Optical Spectroscopy, Devices. His scholarly interests includes Integrated optics, optical spectroscopy, nonlinear optics, dielectric behavior of materials, electronic transport phenomena in solids, electronic and optical phenomena in polymeric and biomolecular systems, nanoscale materials, novel polymeric materials

Dr. Goodhue's expertise is in experimental semiconductor research, materials, fabrication and his research interests include quantum-well-device physics, photonic and optoelectronic device fabrication, vacuum microelectronics, MEMS sensors and molecular beam epitaxy.

5. Microfluidics and Nanofluidics

Collaboration Direction: Reciprocal

DCU Contact: **Professor Jens Ducree**, *Biomedical Diagnostics Institute (bdi)*

UMass, Lowell Contact: **Dr. Bridgette Budhlall**, *Plastics Eng. & Nanomanufacturing Center*
Dr. Hongwei Sun, *Mechanical Eng. & Nanomanufacturing Center*

The BDI is a multidisciplinary research institute focused on the development of next generation biomedical diagnostic devices. These devices, which will directly affect the quality of people's lives worldwide over the coming decades, will be used in Point of Care applications as well as for self-test, home use. The BDI has developed a cutting edge collaborative research program involving leading researchers from academic institutions, companies and the clinical environment to form a complementary, integrated, cohesive partnership.

Prof. Ducree is currently head of the Microfluidics platform and is currently conducting research in the areas of Sealing Technologies and Polymer Coatings for mass producible Lab-on-Chip systems. This program utilizes state-of-the-art microfluidics, biophotonics, MEMS and nanotechnologies to develop integrated microfluidic platforms for advanced diagnostic assays. These devices include features such as multiplied analyte detection, single-cell manipulation, advanced fluid movement control, and pre-assay processing of sample constituents. He also supervises a project that investigates the limits of transport and fluid dynamics in Nanofluidics systems.

Dr. Budhlall is currently developing innovative nanofluidic based technologies for incorporation into a compact, portable Lab-on-Chip device for use in detection and identification of chemical and /or biological agents. Her main objective is to develop a portable device for rapid, real-time (mins) analysis of cells in oral fluids (saliva). Our approach entails using a nanofiber as a nano-needle that is integrated into a Nanofluidic device where they could be used to penetrate the lipid bilayer of single cells injecting or withdrawing samples.

Dr. Sun expertise is in the areas of Micro-Electro-Mechanical Systems (MEMS) and Microfluidics and he is currently studying the fluid dynamics of Alumina Nanofluids.

6. Nanopatterning/Nanofabrication/Nanolithography

Collaboration Direction: Reciprocal

DCU Contact: Professor Jens Ducree, *Biomedical Diagnostics Institute (bdi)*

UMass, Lowell Contact: Dr. Joey Mead, *Plastics Engineering & Nanomanufacturing Center*
Dr. Carol Barry, *Plastics Engineering & Nanomanufacturing Center*

Prof. Ducree is also head of Microsystems in the School of Physics. His current research focus in this area is in polymer micro- and nanofabrication of tools, BioMEMS devices and nanophase bio-lithography.

Drs. Mead and Barry are currently conducting extensive research in the field of Nanofabrication, Directed- Assembly and Pattern transfer including a project on Fabrication of Organic Circuits Using Electric-field-assisted Assembly of Conducting Polymers and Pattern Transfer.

7. Bioimaging Probes

Collaboration Direction: Reciprocal

DCU Contact: Dr. Tia Keyes, *National Centre for Sensor Research (NCSR)*

UMass, Lowell Contact: Dr. Bridgette Budhlall, *Plastics Eng. & Nanomanufacturing Center*

Dr. Keyes particular interest Bioimaging Probes lies in the development of novel systems with controlled degrees of intercomponent communication for potential use in nanoelectronic devices and in luminescent probes for heterogeneous microenvironments and biomaterials, including a project on Self-assembled polymer (poly(oxometallate-Ru(bby)₃) complexes as photocatalyst for biomedical applications.

Dr. Budhlall is currently engaged in the synthesis of spherical solid-stabilized anisotropic nanocolloids for the design of biosensors and *in vivo* imaging probes used in intercellular protein detection and tracking.

8. Polyaniline Hybrids/Nanotubes

Collaboration Direction: Reciprocal

DCU Contact: Dr. Kim Lau and Emer Lahiff, *NCSR*

UMass, Lowell Contact: Dr. Joey Mead, *Plastics Engineering & Nanomanufacturing Center*
Dr. Jayant Kumar, *Adv. Mat. Center & Physics*
Dr. Sanjeev Manohar, *Chemical Engineering & Nanomanufacturing*

Dr. Kim Lau is the Group Projects Manager in NCSR. His research areas of interest include Nanostructured Adaptive platforms using electroactive polymer carbon nanotubes/ nanofibers that respond to pH.

Dr. Mead is currently conducting extensive research in Directed Assembly of Conducting Polymer Using Electrostatically Addressable Template. Conducting polyaniline doped by camphor sulfonic acid and dissolved in dimethylformamide was selectively assembled on the negative electrodes provides a promising nanomanufacturing approach for cost effective and high performance flexible nanoelectronics and biosensors.

Dr. Kumar's expertise is in the areas of Optical and electronic properties of materials, Optical Spectroscopy, Devices. His scholarly interests includes Integrated optics, optical spectroscopy, nonlinear optics, dielectric behavior of materials, electronic transport phenomena in solids, electronic and optical phenomena in polymeric and biomolecular systems, nanoscale materials, novel polymeric materials

Dr. Manohar expertise is in the synthesis and characterization nanofibers and nanotubes of polymers and nanocarbons to fabricate nanofiber-based devices.

9. Photoresponsive Polymers

Collaboration Direction: Reciprocal

DCU Contact: Dr. Kim Lau and Fernando _____, NCSR

UMass, Lowell Contact: Dr. Bridgette Budhlall, *Plastics Eng. & Nanomanufacturing Center*

Fernando is a Post-doctoral student with Dr. Lau. His project focuses on adaptive stimuli-responsive polymers that are photoswitchable and can interact with metals and proteins for medical applications.

Dr. Budhlall uses a novel synthesis of polymer microcapsules with core-shell morphology comprising of Au@Polymer that is microwave-, photo- and thermo-responsive prepared by a novel microarray technique using a double emulsion process. These stimuli-responsive polymer microcapsules have potential applications as microfluidic switches, photosensors, micromachines, and various nanomedicine applications in controlled delivery and release.

10. Commercialization/Incubator

Collaboration Direction: Reciprocal

DCU Contact: Dr Tony Glynn, Patrick McDermott

UMass, Lowell Contact: Dr. Steve McCarty, *Plastics Engineering & M2D2*

Incubator – Steve McCarthy met with Dr. Tony Glynn of “*Invent*”, which is the incubator and commercialization arm of Dublin City University. “*Invent*” has been very successful in helping small companies grow, and they take an equity position in the companies that they help. Dr. Glynn is very interested in collaborating with M2D2 and plans to visit UMass Lowell in 2009.

Trinity College, Dublin. Republic of Ireland.

Centre for Research on Adaptive Nanostructures and Nanodevices, CRANN

CRANN is a Science Foundation Ireland (SFI) funded Centre for Science and Engineering Technology, and comprised of partners in academia, Trinity College Dublin, University College Dublin and University College Cork. In addition CRANN has many industry partners including Intel and Hewlett Packard, along with a number of Irish high tech companies. A unique feature of CRANN is the construction of the 6000m² building. This five-story-over-basement structure provides state-of-the-art nanoscience laboratories, together with a public Science Gallery - a forum for engagement and discussion of scientific issues of the day. CRANN is about the research and innovation that comes from having the best people in the best environment. CRANN provides a unique collaborative and interdisciplinary environment in which fundamental research carried out by teams of internationally renowned experts and leading industry figures is leveraged to address critical issues in Information and Communication Technologies and Biotechnology.

1. Nanopatterning and Nanofabrication

Collaboration Direction: Reciprocal

Trinity Contact: Dr. Yuri Gun'ko, CRANN

UMass, Lowell Contact: Dr. Julie Chen, Mechanical Eng. & Nanomanufacturing Center
Dr. Zhiyong Gu, Chemical Engineering & Nanomanufacturing Center
Dr. Sanjeev Manohar, Chemical Eng. & Nanomanufacturing Center

Prof Gun'ko works in the areas of inorganic chemistry, science of materials and nanotechnology. His main research interest and activities are: magnetic nanoparticles and magnetic fluids for MRI; metallasiloxanes; functionalization of carbon nanotubes and quantum dots for biomedical applications. Prof Gun'ko's work directly links to both the Integrated Nanoscale Devices theme and the BioNanoAssay & Sensing theme.

Dr. Chen's expertise is in electrospinning of nanofibers and her scholarly interests includes the mechanical behavior and deformation of fiber structures, fiber assemblies and composite materials, with an emphasis on analytical modeling, novel experimental measurements, and manufacturing.

Dr. Gu is currently engaged in the synthesis synthesis, self-assembly and integration of multisegment nanowires for electronics and medicine. The techniques utilized surface tension driven self-assembly in a fluidic medium, in which the nanowires were selectively functionalized and then permanently bonded via a polymerizable adhesive. Another technique involved the utilization of nanoscale solder to bond nanowires.

Dr. Manohar expertise is in the synthesis and characterization nanofibers and nanotubes of polymers and nanocarbons to fabricate nanofiber-based devices.

2. Quantum Dots /Integrated Nanodevices

Collaboration Direction: Reciprocal

Trinity Contact: Dr. Yuri Gun'ko, CRANN

UMass, Lowell Contact: Dr. Bridgette Budhlall, *Plastics Eng. & Nanomanufacturing Center*

Prof Gun'ko works in the areas of inorganic chemistry, science of materials and nanotechnology. His main research interest and activities are: magnetic nanoparticles and magnetic fluids for MRI; metallasiloxanes; functionalization of carbon nanotubes and quantum dots for biomedical applications. Prof Gun'ko's work directly links to both the Integrated Nanoscale Devices theme and the BioNanoAssay & Sensing theme.

Dr. Budhlall is currently engaged in the synthesis of quantum dots nanocrystals encapsulated within anisotropic polymer nanocolloids for the design of biosensors and *in vivo* imaging probes used in nanomedicine applications eg., intercellular protein detection and tracking.

3. Surface Coatings for Polymer Nanoparticles

Collaboration Direction: Reciprocal

Trinity Contact: Dr. Adriele Prina-Mello, CRANN

UMass, Lowell Contact: Dr. Bridgette Budhlall, *Plastics Eng. & Nanomanufacturing Center*

Dr. Prina-Mellow is a Post Doctoral Fellow in the group of **Prof Corey**. **Prof. Corey's** research interests include magnetic, electronic and structural properties of solids spin electronics, magnetoelectrochemistry, amorphous materials, physical properties of minerals and permanent magnet applications. Prof Corey is involved in the CRANN research themes Spin Electronics & Sensors and BioNanoAssay & Sensing.

Dr. Budhlall has broad expertise in Nanostructured Polymer Coatings Science & Technology and more than eight (8) years working in industry on architectural emulsion polymer coatings and is currently conducting research on water-borne hybrid nanoparticle/polymers for automotive coatings with improved barrier properties including superhydrophobicity. Dr. Budhlall also currently teaches two (2) graduate level courses in coatings: **26.533 – Coatings Science and Technology I and II** that review the principles of design and formulation of waterborne, high-solids, and powder resins used for the development of solvent-less green coatings and the use of bio-derived resins, including soybean oil and other renewable raw materials. The mechanisms and methods of curing and of polymerization for polymers used as coatings are also covered. In addition, Dr. Budhlall is the only investigator at UMass synthesizing and characterizing functional nanobiocolloids:- vesicles, colloidosomes, polymersomes and polymer hydrogel/nanoparticles nanocapsules that incorporate colloidal gold nanoparticles that comprise stimuli-responsive responsive polymer microcapsules with a polymer shell and liquid-core for drug delivery applications.

4. Polymers for Tissue Engineering

Collaboration Direction: Reciprocal

Trinity Contact: **Dr. Adriele Prina-Mello**, *CRANN*

UMass, Lowell Contact: **Dr. Rudolph Faust**, *Chemistry & Nanomanufacturing Center*
Dr. Daniel Schmidt, *Plastics Eng. & Nanomanufacturing Center*

Dr. Prina-Mellow is a Post Doctoral Fellow in the group of **Prof Corey**. **Prof. Corey's** research interests include magnetic, electronic and structural properties of solids spin electronics, magnetoelectrochemistry, amorphous materials, physical properties of minerals and permanent magnet applications. Prof Corey is involved in the CRANN research themes Spin Electronics & Sensors and BioNanoAssay & Sensing.

Dr. Faust has broad expertise in the preparation of well-defined polymers with controlled architecture, molecular weight, molecular weight distribution and end-functionalities by living cationic, anionic and ring-opening polymerizations; polymerization kinetics and mechanisms; synthesis, characterization and properties of new specialty polymers; new thermoplastic elastomers based on block and graft copolymers, end-functional polymers, organic-inorganic hybrid materials, amphiphilic block copolymers for directed self-assembly of nanostructures and polymers for medical applications.

Dr. Schmidt's scholarly interests include the production of polymer hybrids, including low and high inorganic content nanocomposites and pre-ceramic systems, and porous materials, including tissue engineering scaffolds, polymer-derived catalyst supports and shape memory foams.

5. Educational Outreach/ Science Center

Collaboration Direction: Reciprocal

Trinity Contact: **Keelin Murphy**, *CRANN and Center for Biotechnology*

UMass, Lowell Contact: **Dr. Carol Barry**, *Plastics Engineering & Nanomanufacturing Center*

The Trinity biotechnology Center has a large educational outreach effort with the first floor devoted to K-12 display and interactive science and a shop with nano related products to buy. They have posters, brochures and a CD videogame on nano for free.

Dr. Barry is in charge of our K-12 education outreach programs and would be a synergistic connection.

6. QCM Tumor vascularization and Novel Chemotherapeutic Agents for the treatment of human cancer

Collaboration Direction: Reciprocal

Trinity Contact: **Dr. Marek Radomski, CRANN**

UMass, Lowell Contact: **Dr. Susan Brauhn**, *Biology & Nanomanufacturing Center*

Dr. Ken Marx, *Chemistry & Nanomanufacturing Center*

Dr. Joel Therrien, *Electrical Eng. & Nanomanufacturing Center*

Mark Tris & Clayton French, *Physics*

Dr. Radomski works with biosensors, synthetic novel chemotherapeutics, vascular biology and tumor vascular biology. He has several research projects that parallel those of **Dr. Brauhn** at UML and her collaborators. Having been exposed to high level radiation after the accident at Chernobyl, he is also interested in radiation mitigating agents and radio-protectors.